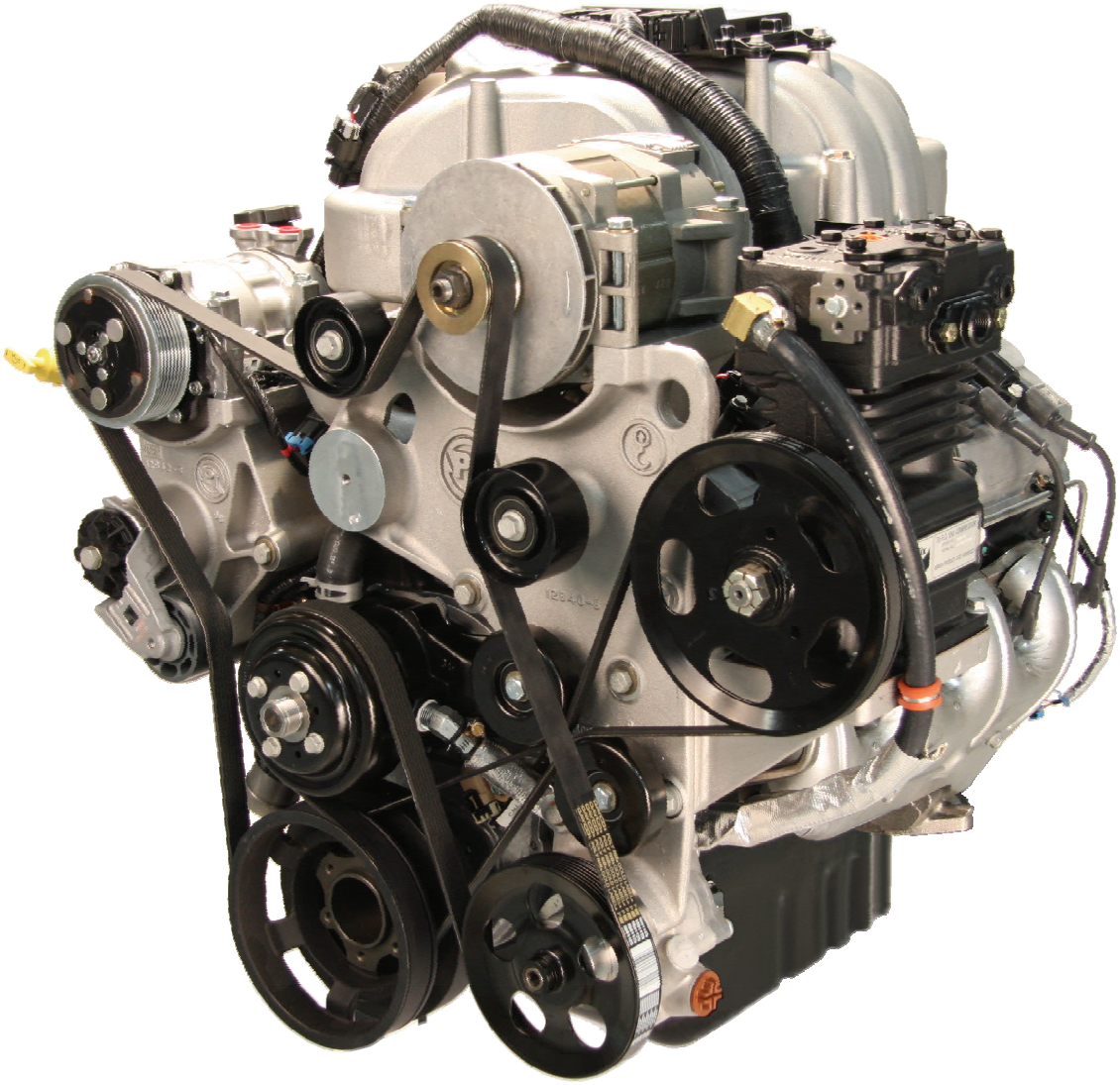
OPERATOR'S MANUAL

8.0L LPG V8 ENGINE



Powertrain Integration

LIQUID PROPANE INJECTION BY
CLEANFUEL
USA

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OPERATOR'S MANUAL
8.0 L V8 ENGINE – LPG

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FOREWARD

This manual contains the latest information available at the time of publication. Powertrain Integration, LLC reserves the right to make future changes in the products or information contained in this manual without prior notice.

Keep this manual with the vehicle. If the vehicle is traded or sold, give this manual to the future owner.

WARNINGS, CAUTIONS and NOTES

This manual contains several different WARNINGS, CAUTIONS, and NOTES that must be observed to prevent personal injury and/or damage to the engine, fuel system or personal property.

⚠ WARNING

A warning statement is used when an operating procedure, practice, etc., which, if not correctly followed, could result in serious personal injury or loss of life.

⚠ CAUTION

A caution statement is used when an operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or damage to or destruction of equipment.

NOTE: A note is used when an operating procedure, practice, etc. is essential to highlight.

IMPORTANT: An important statement generally denotes a situation which requires strict adherence to the assembly, tightening, or service procedure. Failure to observe this procedure could result in an unsafe condition, improper performance of the engine or fuel system, and may influence the terms of the warranty.

SECTION I
INTRODUCTION

Your new Powertrain Integration 8.0L engine has been designed and built to operate on Liquefied Petroleum Gas (LPG), commonly referred to as propane or autogas. Propane fuel is readily available and, when used as an engine fuel, provides a reduction in harmful exhaust emissions.

This manual has been prepared as a supplement to the OEM operator manual to inform the operator of the specific items regarding the engine.

USING THIS MANUAL

This manual contains information which is unique to the Powertrain Integration 8.0L LPG engine. It should be used in conjunction with the OEM Operator Manual. If, after reviewing the information contained in this manual, there are questions about the information please contact Powertrain Integration (Refer to Section V, Customer Assistance Information) for clarification.

It is recommended that this manual be completely reviewed upon receipt of vehicle. This will allow familiarization of the operation and special features of the Powertrain Integration 8.0L LPG engine.

BREAK IN PERIOD NEW ENGINE

The engine does not need an elaborate break-in. However it will perform better if these basic guidelines are followed:

- **Use conventional oil (non-synthetic) for first 10,000 miles**
- **For the first 500mi (805km):**
  - Keep the vehicle speed at 55 mph (88km/h) or less.
  - Do not drive at any one constant speed. Vary vehicle speed within posted speed limits.
  - Avoid wide open throttle acceleration.
  - Avoid downshifting to brake or slow the vehicle.
  - Avoid steady idling for extended periods (longer than five minutes).

NOTE: Oil consumption is normal during operation of a propane engine. The rate of consumption is highly dependent on vehicle load, city, and highway driving and duty cycles. New engines may experience higher oil consumption during the engine break-in period. After the break-in period, oil usage up to one quart per 1,500 miles is in the acceptable range. Oil level should be checked at every fuel stop.

OIL CHANGE INTERVALS

The engine oil and filter must be changed every 5,000 miles (8,064 km). The crankcase capacity is 8 qts, 9 qts with the filter. Refer to the OEM operator manual for oil change instructions.

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SECTION II
OPERATING INSTRUCTIONS

STARTING THE ENGINE

IMPORTANT: For service issues and questions call **Powertrain Integration.** Representatives will be able to answer questions and diagnose mechanical issues as well as provide detailed service repair information.

Prior to operating the vehicle perform engine pre-trip inspection and daily maintenance checks. Refer to the OEM Operator Manual.

⚠ CAUTION

If the engine does not start on the first attempt make sure that the engine has completely stopped rotating before reapplying the starter switch. Failure to do so may cause ring gear and starter pinion damage. Ring gear and starter pinion damage caused by improper starting procedures is not warrantable.

⚠ CAUTION

Never attempt to start any electronically-controlled engine using ether or any other starting fluid. Serious engine damage, or personal injury, could result.

NOTE: Starting a LPG (propane) engine is slightly different than a gasoline vehicle. Before the vehicle will start the engine must be supplied with liquid fuel. Since the previous run period the fuel may have expanded or vaporized in the fuel lines and injectors. A priming process is activated each time the ignition key is rotated to the ON position.

IMPORTANT: Do not depress the throttle pedal while starting the engine.

1. Make sure that the transmission shift control is in Neutral (N) and the Parking Brake is set.
2. Turn the ignition switch to the ON position. The Wait to Start Lamp in the instrument cluster will illuminate for a brief time.

⚠ CAUTION

Ignoring the Wait to Start lamp may result in a backfire through the intake manifold, rough idle, slow run-up, or hesitation on first tip in.

⚠ CAUTION

Do not crank the engine for more than 30 seconds at a time. Wait two minutes after each try to allow the starter to cool. Failure to do so may cause starter damage.

3. When the Wait to Start lamp goes out, do the following:
4. Rotate the ignition key to the START position. After the engine starts, release the key.
5. After the engine has started let it run for 20-30 seconds before a load is put on the engine. Bring the engine up to operating speed gradually as it warms up and develops stable oil pressure.

IMPORTANT: When the engine is started it takes a short time to build up a lubricating oil film between the shafts and bearings, and between the pistons and cylinder walls.

6. Do not race the engine immediately after starting it. Operate the engine and transmission gently until the oil warms up and lubricates all moving parts.
7. If the vehicle starts briefly but then stops, turn the key to the OFF position for at least three (3) seconds, then repeat the starting process.

⚠ WARNING **If the vehicle is left with the engine running, it could potentially overheat or the vehicle could move suddenly if the shift lever is not fully engaged in Neutral (N) and the Parking Brake firmly set. Do not leave the engine running if the vehicle is unattended.**

⚠ WARNING

It is best to not leave the vehicle parked with the engine running, but, if required, please note that idling a vehicle in an enclosed area with poor ventilation is dangerous. Engine exhaust may enter the vehicle. Never run the engine in an enclosed area that has no fresh air ventilation.

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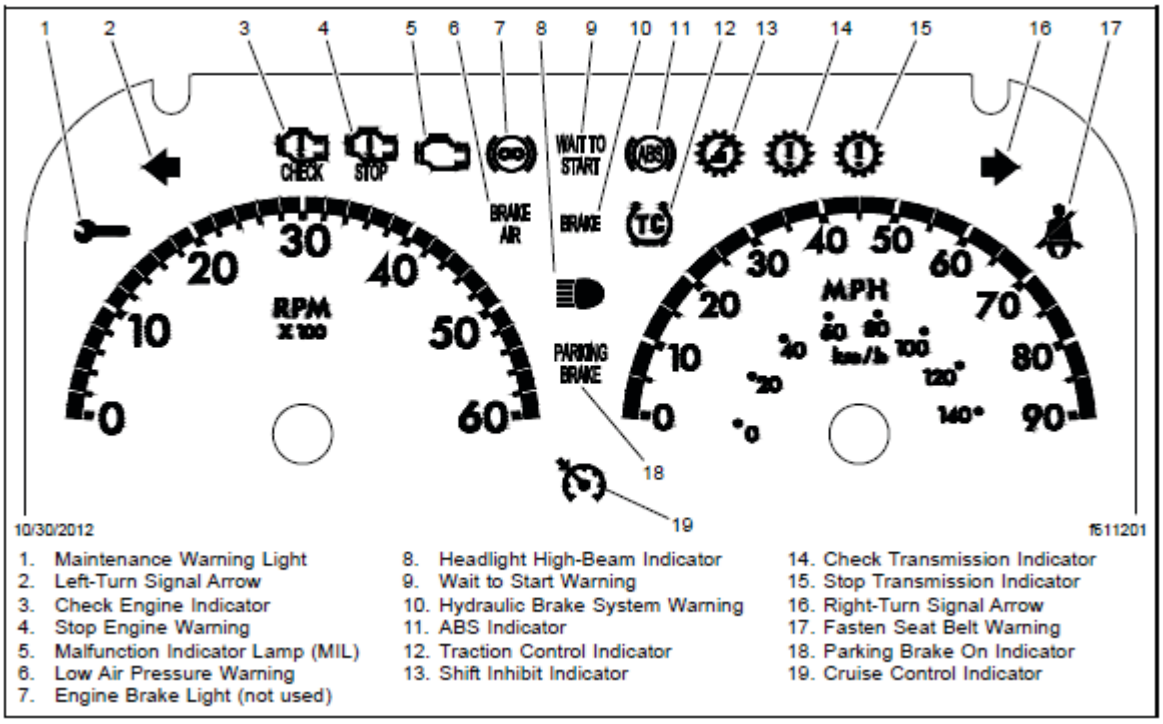

1. Maintenance Warning Light
2. Left-Turn Signal Arrow
3. Check Engine Indicator
4. Stop Engine Warning
5. Malfunction Indicator Lamp (MIL)
6. Low Air Pressure Warning
7. Engine Brake Light (not used)
8. Headlight High-Beam Indicator
9. Wait to Start Warning
10. Hydraulic Brake System Warning
11. ABS Indicator
12. Traction Control Indicator
13. Shift Inhibit Indicator
14. Check Transmission Indicator
15. Stop Transmission Indicator
16. Right-Turn Signal Arrow
17. Fasten Seat Belt Warning
18. Parking Brake On Indicator
19. Cruise Control Indicator

ENGINE WARNING LAMPS

WAIT TO START LAMP

The **WAIT TO START** lamp will illuminate for a brief time after the key is turned to the run position. This waiting period allows the fuel rails to be purged of vapor and supplied with liquid propane fuel. Engine cranking is possible, but not recommended while the lamp is on. When the lamp turns off and the key is turned to the start position the engine will start. If the engine is not started within 15 seconds after the lamp goes out the key should be cycled back to the off position and then again to the run position to repeat the wait to start process.

CHECK

CHECK ENGINE LAMP (Steady)

A steady illumination of the **CHECK ENGINE LAMP** indicates that there is a fault with some aspect of the engine operating system. Some faults may put the engine into a reduced power mode to protect components. This reduction in power will be noticeable to the operator of the vehicle. The vehicle should be taken to an OEM authorized service facility for service as soon as possible. Failure to maintain the engine operating system could void the warranty.

CHECK

CHECK ENGINE LAMP (Flashing)

A flashing **CHECK ENGINE LAMP** is an indication of an engine misfire. Misfires occur when the combustion process in one or more cylinders is not properly completed. This could lead to fuel passing through the engine and into the exhaust system, which could damage catalytic converters. Individual cylinders may be deactivated as a means to protect the catalytic converters, which will result in a decrease in engine power. To prevent more serious damage to the vehicle:

- Reduce engine speed.
- Avoid hard accelerations.
- Avoid steep uphill grades.

If the light continues to flash, find a safe place to stop and park the vehicle. Turn the vehicle off, wait at least 10 seconds, and restart the engine. If the light is still flashing have the vehicle serviced as soon as possible. The engine should not be operated for extended periods while a flashing **CHECK ENGINE LIGHT** is present or damage to the catalytic converters will result. Catalytic converters damaged by driving the vehicle with a flashing check engine light are not covered under warranty. The vehicle should be taken to an OEM authorized service facility for ser-

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vice as soon as possible. Failure to maintain the emissions system could void the warranty.

MALFUNCTION INDICATOR LAMP (MIL)

⚠ CAUTION

If the vehicle is continually driven when the MIL is activated, the emission controls may not function, the vehicle fuel economy may deteriorate, and the engine may not run smoothly. This could lead to costly repairs that may not be covered by the engine warranty.

NOTE: Modifications made to the engine, transmission, exhaust, intake, fuel system of the vehicle, or replacing the original tires with tires that do not meet the same tire performance criteria may affect the vehicle's emission controls and can cause the MIL to activate. Modifications to these systems could lead to costly repairs not covered by the engine or vehicle warranty. This could also result in a failure to pass required emission inspection and/or maintenance tests.

A **MALFUNCTION INDICATOR LAMP** indicates that a malfunction has been detected in the vehicle emission system. The vehicle can continue to be driven normally. Diagnosis and service may be required to correct the malfunction. The vehicle should be taken to an OEM authorized service facility for service as soon as possible. Failure to maintain the emissions system could void the warranty.

STOP ENGINE LAMP

The **STOP ENGINE LAMP** indicates that a severe fault condition exists and the engine should be shut down as soon as it is safe to do so. Damage to the engine and/or catalytic converter may already be occurring or have occurred when this lamp illuminates. When the **STOP ENGINE LAMP** illuminates the engine will go in to reduced power mode. If the engine is shut down while the vehicle is in service, a single restart attempt may be performed. Depending on the nature of the fault condition, a cool-down period may be required before restarting. If, upon restarting, the fault condition still exists the lamp will come on and the engine should be shut down. At this point the vehicle is unsafe to drive and should be transported to an OEM authorized service facility.

FUEL

IMPORTANT: Using the recommended fuel (propane) is an important part of the proper maintenance of this vehicle.

This engine is powered by clean burning Liquefied Petroleum Gas (LPG), commonly referred to as propane or autogas. Propane is recognized worldwide for its contribution to lower emissions, cleaner air, energy independence and lower operating costs.

It is recommended to use HD5 grade propane. HD5 is Heavy Duty Engine grade propane with a minimum of 90% propane and a maximum of 5% propylene. This grade of propane is 100 plus octane and will provide proper performance and emissions control, which the fuel system is designed to deliver.

The fuel should be free of contamination including but not limited to rust, dirt, sand water, salt and brine. Damage to components resulting from gross contamination is NOT covered under warranty.

LPG is colorless, odorless and is stored as a liquid in the fuel tank. A distinctive odorant is added to LPG for safety. The odor smells similar to sulfur or rotten eggs.

ENGINE EXHAUST

⚠ WARNING

Engine exhaust contains carbon monoxide (CO) which cannot be seen or smelled. Exposure to CO can cause unconsciousness or loss of life.

Engine exhaust may enter the vehicle if:

- The vehicle idles in areas with poor ventilation (parking garages, tunnels, deep snow that may block underbody airflow or tail pipes);
- The exhaust smells or sounds strange or different;
- The exhaust system leaks due to corrosion or damage;
- The vehicle exhaust system has been modified, damaged, or improperly repaired;
- There are holes or openings in the vehicle body from damage or aftermarket modifications that are not completely sealed.

If unusual fumes are detected or if it is suspected that exhaust is coming into the vehicle:

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- Drive it only with the windows completely open.
- Have the vehicle repaired immediately.

Never leave the engine running with the vehicle parked in an enclosed area such as a garage or a building that has no fresh air ventilation.

SECTION III
SERVICE AND MAINTENANCE

GENERAL INFORMATION

A vehicle with the 8.0L LPG engine is an important investment. Proper maintenance helps to keep the engine and vehicle in good working condition, improves fuel economy, and reduces vehicle emissions for better air quality. It is recommended that ASE-trained technicians perform these services. This section describes the required maintenance for the engine. The owner/operator of the vehicle is responsible for scheduled maintenance.

⚠ CAUTION

Damage caused by improper maintenance can lead to costly repairs and may not be covered by the engine warranty. Maintenance intervals, checks, inspections recommended fluids, and lubricants are important to keep the engine in good working condition.

Maintenance needs vary due to the different ways vehicles are utilized. The vehicle might need more frequent checks and services. Please read the information under Scheduled Maintenance. To keep the vehicle in good condition, see your dealer.

The proper replacement parts, fluids, and lubricants to use are listed in Recommended Fluids and Lubricants. We recommend the use of genuine parts from your dealer.

PERFORMING SERVICE WORK

⚠ WARNING

Some maintenance work can be dangerous and cause serious injury. Perform maintenance work only if the required information, proper tools and equipment are available. If the information/tools are not available, seek out a trained technician to perform the work.

If performing service on engine, use the proper service manual. The service manual provides in-depth detail on how to service the engine.

Keep detailed maintenance records. List the mileage and the date of any service work performed.

ENGINE OIL

To ensure proper engine performance and long life, careful attention must be paid to engine oil. Following these simple, but important steps will help protect the vehicle:

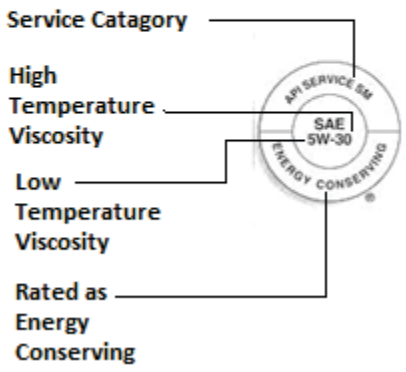
- Always use engine oil approved to the proper specification and of the proper viscosity grade.
- Check the engine oil level at every fuel stop and maintain the proper oil level. See Checking Engine Oil on page 12.
- Change the engine oil at the appropriate maintenance intervals

⚠ CAUTION

Use engine oil that is identified as American Petroleum Institute (API) "SN" (or most current) standard. Failure to use the recommended oil can result in engine damage and will void the engine warranty.

When determining the type of engine oil to use, look for:

- The API starburst symbol. Oils that display the starburst symbol must meet the requirements of ILSAC GF-2 to display the mark.



- **SAE 5W-30** (The recommended oil for the Powertrain Integration engine.)

SAE 5W-30 has the best viscosity grade for the engine. Do not use other viscosity oils such as SAE 10W-30, 10W-40, 15W40, or 20W-50. Conven-

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tional oil (non-synthetic) is recommended for the first two oil changes and any "top-off" through 10,000 miles (16,000 km). Partial or fully synthetic oils may be used after the first two oil changes.

ENGINE OIL ADDITIVES

Do not add anything to the oil. The recommended oils with the API starburst symbol are all that is needed for good performance and engine protection.

ENGINE OIL FLUSHES

NOTE: Engine oil system flushes are not recommended and could cause engine damage not covered by the engine warranty.

CHECKING ENGINE OIL

It is important to check the engine oil level regularly and keep it at the proper level. In order to get an accurate reading, the vehicle must be on level ground.

Obtaining an accurate oil level reading is essential:

1. Turn off the engine and allow several minutes for the oil to drain back into the oil pan. Checking the oil level too soon after engine shutoff will not provide an accurate oil level reading.
2. Pull out the dipstick and clean it with a paper towel or cloth, then push it back in all the way. Remove it again, keeping the tip down, and check the level.
3. If the oil is below the crosshatched area at the tip of the dipstick, add 1 quart (liter) of the recommended oil and then recheck the level.
4. Add enough oil to put the level in the crosshatched area on dipstick. Push the dipstick all the way back in when finished.

NOTE: Oil should be within the cross-hatched area of the dipstick.
Oil levels that are above or below the acceptable operating range (the crosshatched area on the dipstick) are harmful to the engine. If the oil level is above or below the operating range oil should be added or removed to bring it into the operating range. Operating the engine when the oil is not in the operating range could cause engine damage.

CHANGING THE ENGINE OIL

The engine oil and filter must be changed every 5,000 miles (8,064 km) or less depending on operating conditions. The crankcase capacity is 8 quarts, 9 with the filter. Refer to the OEM Operator Manual for oil change instructions.

OIL CONSUMPTION

All engines require oil to lubricate and protect the load bearing and internal moving parts from wear including cylinder walls, pistons and piston rings. When a piston moves down its cylinder, a thin film of oil is left on the cylinder wall. During the power stroke, part of this oil layer is consumed in the combustion process. As a result, varying rates of oil consumption are accepted as normal in all engines.

Oil consumption is normal during operation of the 8.0L propane engine. The rate of consumption is highly dependent on vehicle loading, highway/city driving and duty cycles. New engines may experience higher oil consumption during the engine break-in period. After the engine break in period, the acceptable rate of oil consumption for the 8.0L Powertrain Integration propane engine is one quart per 1,500 miles (2,414km).

For further information refer to the Powertrain Integration Service Manual or contact Powertrain Integration.

ENGINE AIR CLEANER FILTER

Inspect the air cleaner filter at the scheduled maintenance intervals and replace it when the restriction indicator reaches 15 inches H2O/3.7kpa. Refer to the OEM Operator Manual for more information. If driving in dusty/dirty conditions, inspect the filter at each engine oil change.

INSPECTING THE ENGINE AIR CLEANER FILTER

Prior to inspection, turn the engine OFF. Refer to the OEM Operator Manual for proper procedure. Never use compressed air to clean the filter.

COOLING SYSTEM / ENGINE COOLANT

The cooling system allows the engine to maintain the correct working temperature.

The cooling system in the vehicle is filled with an Organic Acid Technology with a Nitrite Additive (NOAT) Extended Life Coolant (ELC). With proper maintenance this coolant is designed to remain in

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the vehicle for six (6) years or 600,000 mi (960,000km), whichever occurs first.

⚠ CAUTION

Using engine coolant other than the factory fill can cause premature engine, heater core, or radiator corrosion. In addition, the engine coolant could require changing sooner, at 50 000 km (30,000 mi) or 24 months, whichever occurs first. Any repairs would not be covered by the vehicle warranty.

⚠ CAUTION

Using an improper engine coolant mixture could cause the engine to overheat. The repair cost would not be covered by the warranty. Too much water in the mixture can freeze and crack the engine, radiator, heater core, and other parts.

For the LPG engine, a 50/50 pre-mixture coolant should be used. If this mixture is used nothing else needs to be added. This mixture will:

- Give freezing protection down to -34°F (-37°C);
- Give boiling protection up to 265°F (129°C);
- Protect against rust and corrosion;
- Will not damage aluminum parts;
- Provide water pump lubrication;
- Help keep the proper engine temperature.

⚠ WARNING

The coolant warning system is set for the proper coolant mixture (50/50 pre-mixture coolant). Over time, water may permeate through hoses, resulting in a coolant-rich mixture in the cooling system. Always use test strips appropriate for the coolant type to check the coolant properties. Top off the cooling system accordingly to maintain a 50/50 mixture.

⚠ CAUTION

Severe engine damage may result from running the engine when low on coolant or out of coolant. Engine damage caused by running the engine low on coolant or out of coolant is not covered by the engine warranty.

CHECKING COOLANT

Refer to the OEM Operator Manual for checking engine coolant levels and coolant conditions (i.e.; rust, cloudy, dirt, other contaminants).

ENGINE OVERHEATING

⚠ WARNING

Steam from an overheated engine can cause burns. Stay away from the engine and vehicle hood if steam is seen or heard. Turn off the engine and move away from the vehicle until the engine cools down. Wait until there is no sign of steam or coolant before opening the vehicle's hood. If driving continues when the engine is overheated, severe engine damage could result.

The vehicle has indicators to warn of engine overheating. Refer to the OEM Operator Manual for location of the vehicle's coolant temperature gauge.

If the engine becomes overheated there will be a warning buzzer and a message will appear in the instrument cluster. The following actions may help the engine return to normal operating temperature:

- Reduce engine speed.
- Avoid hard accelerations.
- Avoid steep uphill grades

If the condition does not improve The **CHECK ENGINE LAMP** and **STOP ENGINE LAMP** will come on, the engine will go into reduced power mode, and the idle speed will increase to speed up the water pump and cooling fan to cool the engine. If the **CHECK ENGINE LAMP** and the **STOP ENGINE LAMP** are on, pull over as soon as it is safe, stop the vehicle, set the parking brake and turn off the engine.

If the decision is made to open the hood, make sure the vehicle is parked on a level surface and that there is no danger from steam, leaking fluids and hot surfaces. Inspect for:

- Broken or missing accessory drive belts.
- Obstructions or debris in front of the vehicle radiator and grill
- Coolant level by looking at the surge tank (**do not remove the surge tank cap**).
- Fluid Leaks.

The **STOP ENGINE LAMP** and buzzer will go out when the engine reaches normal operating temperature. The **CHECK ENGINE LAMP** will remain on until an inspection service is performed at an OEM authorized service facility.

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If it is determined that there are no mechanical failures or coolant loss, and the engine has cooled down and the vehicle is safe to drive, the vehicle may be driven to an OEM authorized service facility for inspection as soon as possible.

EMISSION CONTROL EQUIPMENT

Some state/provincial and local governments may have programs to inspect the on-vehicle emission control equipment. For the inspection, the emission system test equipment is connected to the vehicle's Data Link Connector (DLC).

The DLC is under the instrument panel to the left of the steering wheel.

The vehicle may not pass inspection if:

- The malfunction indicator lamp is on with the engine running; or
- If the light does not come on when the ignition is turned to ON/RUN while the engine is off.

SECTION IV
MAINTENANCE SCHEDULE

AT EACH FUEL STOP

- Check engine oil level.
- Check engine coolant level.

AT EVERY ENGINE OIL CHANGE

- Change engine oil and filter.
- Perform visual inspection of oil cooler hoses and fittings
- Check engine coolant level.
- Inspect engine cooling system. Visual inspection of hoses, pipes, fittings, and clamps. Replace, if needed.
- Inspect engine air cleaner filter.
- Visual inspection of accessory drive belts for fraying, excessive cracking or damage. Replace as necessary.

NOTE: Refer to the OEM Operator Manual for service procedures.

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Recommended Vehicle Maintenance Schedule

Description	Maintenance Interval Frequency*			
	Miles	Kilometers	Hours	Months
Change Oil & Filter	5,000	8,000	150	3
Inspect Evaporative Control System (1)	30,000	48,000	1,000	12
Replace Fuel Fill and Inline Filters	30,000	48,000	1,000	36
Inspect Fuel System (5)	30,000	48,000	1,000	12
Replace Engine Air Cleaner Filter (2)	50,000	80,000	1,500	36
Replace Spark Plugs & Inspect Spark Plug Wires	50,000	80,000	1,500	36
Replace Spark Plug Wires	100,000	160,000	3,000	60
Coolant Quality Checks (3)	Perform Annual Checks (3)			
Inspect Engine Drive Belt Tensioner (4)	50,000	80,000	1,500	36

*Which ever occurs first.

Foot Notes:

(1) Check all fuel and vapor lines and hoses for proper connections and condition.

(2) Check recommended miles, kilometers or every three years.

(3) Use coolant test strips and refractometers to verify freeze point, ph, concentration and corrosion inhibitor levels. The coolant should also be visually inspected for dirt, rust and/or other forms of contamination. Service the coolant system as needed to correct any out-of-range measurements or contamination.

(4) Articulate the tensioner to verify proper function. Inspect stops for contact. If any stop has contacted the body stops, replace the belt and reinspect the tensioner. Inspect the belts for wear, fraying, and cracking across the ribs. Pulleys should be quiet and spin without binding. Inspect the pulley bearings for wear or looseness.

(5) Inspect the Fuel Tank, Fuel Lines, Fuel Rail and Injectors.

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RECOMMENDED FLUIDS AND LUBRICANTS

Fluids and lubricants identified below by name, part number, or specification can be obtained from your dealer.

USAGE	FLUID/LUBRICANT
Engine Oil	Conventional SAE 5W-30 is recommended.
Engine Coolant	Must meet the following: Daimler Spec. 48-254961 Detroit Diesel Spec. 93K217 ASTM D6210 Organic Acid Technology with Nitrite Additive (NOAT) Extended Life Coolant (ELC) 600,000 mile minimum service life guarantee Ethylene Glycol based Silicate and phosphate free

MAINTENANCE REPLACEMENT COMPONENTS

PART	POWERTRAIN INTEGRATION PART NUMBER	GM / AC Delco PART NUMBER (if applicable)
Engine Oil Filter	11020	PF1218
Spark Plugs*	11309	41-963
Plug Wires	11028	N/A
Air Compressor Drive Belt	11162	N/A
PCV Valve	11105	N/A

*Spark plug gap 0.050

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SECTION V
WARRANTY
LIMITED WARRANTY ON 8.0L LPG ENGINES

PRODUCTS WARRANTED

This warranty applies to new 8.0L V8 engines sold by Powertrain Integration, LLC, on the vehicle it was originally installed in. The 8.0L engines are fueled by Liquefied Petroleum Gas (LPG), also known as propane or autogas.

BASE ENGINE WARRANTY

Powertrain Integration warrants that its engines sold with this Warranty will meet all applicable specifications and, under normal use and service, be free from defect in material or factory workmanship (Warrantable Condition). This Coverage begins with the in service date of the vehicle and continues for the Terms and Conditions stated herein. If the in service date of the vehicle cannot be determined, the start of warranty date will be the date the chassis was manufactured.

CLAIMS

All warrantable conditions eligible for warranty claims for 8.0 LPG engines must be made by calling the toll free number **855-305-1500** upon initial discovery of an engine needing repair. Any repairs made or completed prior to calling and receiving claims or repair authorization will make that repair ineligible for claims coverage. Prior to issuing an Authorization Number, or paying the repair cost, we reserve the right to; review/inspect any documentation regarding the vehicle including but not limited to maintenance records OEM vehicle analysis software reports, and parts in their failed state. Defective items must be held for inspection or return to Powertrain Integration or its authorized service facility within 90 days from the date of repair.

Additional coverage is outlined in the Emission Warranty Section.

REPAIRS

Powertrain Integration will pay for parts and labor (based on the current Powertrain Integration Labor Time Guide) needed to repair the damage to the Engine resulting from a Warranted claim.

Parts used in any repair(s) may be new parts or industry approved rebuilt, remanufactured, or Like Kind and Quality (LKQ) parts. Powertrain Integration is not responsible for failures resulting from the use of parts not approved by Powertrain Integration.

New and/or approved Powertrain Integration part(s) used in repairing a warranted claim, those parts then assume the remaining eligible time and mileage of the remaining warranty term.

Powertrain Integration is not responsible for any modified production components or the addition of aftermarket accessories.

SERVICE SUPPLIES

Powertrain Integration will pay for the applicable replacement of the required fluids and filters in the event of an authorized eligible claim. Other components/items that have normal manufacturer replacement intervals are non-eligible for replacement by Powertrain Integration.

ENGINE REMOVAL AND REINSTALLATION

Powertrain Integration pays reasonable labor costs (based on the current Powertrain Integration Labor Time Guide) for Engine removal and re-installation when necessary to repair a valid Warranted authorized claim.

TOWING

On eligible Warranted authorized claims, Powertrain Integration will pay reasonable costs for towing a disabled vehicle, (up to $450.00) if eligible, to the nearest authorized repair location for the first year from the date of delivery of the Engine or to the first owner.

THIS WARRANTY DOES NOT COVER:

Repairs Due to Accidents, Comprehensive losses, Misuse, Storage Damage, Negligence or any Modifications

MAINTENANCE

Owner is responsible for the continued operation and continued maintenance of the Engine as specified in the applicable Powertrain Integration Operation and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed in the event of a claim. Owner must keep verifiable receipts detailing the date, mileage/hours and type of services performed. All other components must be serviced and maintained in strict accordance with the manufacturers written instructions.

INCIDENTAL OR CONSEQUENTIAL DAMAGES

Powertrain Integration is not responsible for incidental or consequential costs, which the owner may

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incur as a result of a malfunction or failure if covered by this warranty, such as vehicle damage, earnings, personal damage(s) storage, communication costs, per diem expenses, meals, lodging, overtime, loss of use, time, inconvenience, cargo loss or damage, and/or other similar costs and expenses.

LIMITATIONS AND EXCLUSIONS

This Warranty only applies to manufacturing defects in material and workmanship on the Engine. Refer to Base Engine Warranty for a listing of covered components. The Warranty shall not apply to the following:

a) Damage or loss caused in whole or in part by the acts or omissions of any kind by any party other than Powertrain Integration;
b) Damage to or from a non-covered part.
c) Damage or loss caused in whole or in part by misuse, abuse, negligence, theft, abnormal operation, vandalism, alteration or modification of the Engine, improper installation, lack of maintenance, unauthorized repair(s) or failure to follow instructions supplied with the Engine;
d) Damage(s) or loss caused by any operation of the Engine with fuels, oils or lubricants that are contaminated, lacking or underfilled or unsuitable for the Engine, including a breakdown caused by the failure to replace seals or gaskets in a timely manner;
e) Damage or loss caused by continued operation of an impaired Engine with knowledge, or a reason to suspect, that a defective condition exists;
f) Damage or loss occurring during shipment (claims must be presented to carrier);
g) Damage or loss caused whole or in part by exposure to natural atmospheric elements or corrosive chemicals;
h) Damage or loss caused in whole or in part from a collision or comprehensive loss;
i) Blown head gaskets, seals or gaskets, fluid leaks, cracked heads or block, overheating or other engine failures caused by a lack of suitable fluids, improper maintenance or continued operation of an impaired vehicle;
j) Damage or loss to the Engine and/or vehicle caused by collision, misuse, lack of maintenance, lubrication, cooling and/or intake systems, unauthorized modifications of the Engine, over fueling, road conditions, negligence, overloading, fires, floods, riots, acts of war, acts of God, commission of any crime;
k) A gradual reduction in operating performance due to normal wear and tear, such as, but not limited to: valve guides, valves, rings or oil consumption, or normal maintenance items;
l) Equipment, components, items, materials, products or goods that are manufactured or supplied by companies other than Powertrain Integration, or which are separately warranted by another manufacturer or supplier of such equipment and/or components is the warrantor of these said items;
m) Routine maintenance of the Engine.

THIS WARRANTY SET FORTH HEREIN IS THE SOLE WARRANTY MADE BY POWERTRAIN INTEGRATION WITH REGARD TO THESE ENGINES. POWERTRAIN INTEGRATION MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

ENGINE EMISSIONS WARRANTY

See CleanFUEL USA (CFUSA) Limited Warranty

LIMITATIONS

Engines must be operated using only Liquefied Petroleum Gas (LPG). It is recommended to use HD5 grade propane. HD5 is Heavy Duty Engine grade propane with a minimum of 90% propane and a maximum of 5% propylene. This grade of propane is 100 plus octane and will provide proper performance and emissions control, which the fuel system is designed to deliver.

Failures, other than those resulting from defects in material or factory workmanship, are not covered by this Warranty.

Powertrain Integration is not responsible for failures or damage resulting from what Powertrain Integration determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; over-fueling; over-speeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

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Powertrain Integration is not responsible for failures caused by incorrect oil, fuel, water, dirt or other contaminants in the fuel.

Powertrain Integration is not responsible for non-Engine repairs, “downtime” expenses, cargo damage, fines, all applicable taxes, and business costs and other losses resulting from a Warrantable Condition.

POWERTRAIN INTEGRATION IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

CALIFORNIA EMISSION WARRANTY, ON-HIGHWAY

See CleanFUEL USA (CFUSA) Limited Warranty

OWNER’S WARRANTY RESPONSIBILITIES

As the engine owner, you are responsible for the performance of the required maintenance listed in your Powertrain Integration Operator’s Manual.

Powertrain Integration recommends that you retain all receipts covering maintenance on your engine, but Powertrain Integration cannot deny warranty solely for the lack of receipts or for your failure to substantiate the performance of all scheduled maintenance.

You are responsible for presenting your engine to a Powertrain Integration authorized service location as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time.

Owner is responsible for incidental costs such as: communication expenses, meals, lodging incurred by Owner or employees of Owner as a result of a Warrantable Condition.

Powertrain Integration is not responsible for “downtime” expenses, cargo damage, fines, all applicable taxes, business costs, and other losses resulting from a Warrantable Condition.

POWERTRAIN INTEGRATION IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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8.0L LPG ENGINE WARRANTY COVERED PARTS

School Bus

5 Years, 100,000 miles / 160,000 km*

*Whichever occurs first, $10,000 per engine.

Delivery Vehicle

2 Years, Unlimited miles or 2,000 hours*

*Whichever occurs first, $10,000 per engine.

Camshaft
Connecting Rods
Crankshaft
Crankshaft Balancer Bolt
Crankshaft Reluctor Wheel
Cylinder Head Bolts
Cylinder Head Gasket
Cylinder Heads
Engine Block
Exhaust Manifold Gasket
Exhaust Manifolds
Front Timing Cover
Front Timing Cover Seal
Intake and Exhaust Valves
Intake Manifold Gasket
Lifter Valley Baffle
Oil Pan Gasket
Oil Pump Assembly
Oil Stem Valve Seal
Piston Pins
Pistons
Rear Crankshaft Oil Seal
Rocker Arm Assembly
Rocker Arm Stud
Timing Chain Assembly
Timing Cover Gasket
Upper Intake Manifold O-Ring
Valve Cover Gaskets
Valve Guide
Valve Lifters
Valve Push Rods
Valve Retainers
Valve Springs
Water Pump

8.0L LPG WARRANTY COVERED PARTS

2 Years, 24,000 miles / 38,500 km*

School Bus and Delivery Vehicle

*Whichever occurs first,

Air Brake Compressor Bracket
Air Brake Compressor Pulley
Crankshaft Balancer
Crankshaft Pulley (Dual A/C)
Engine Harness
Front Engine Mount
Heater Valve Bracket
Idler Pulleys
Injector Harness
Main Accessory Drive Bracket
Molded Air Induction Tube
Oil Cooler Bypass Adapter
Oil Filter Fitting
Oil Pan and Drain Plug
Rocker Covers
Single and Dual A/C Mounting Brackets
Tensioners
Thermostat Housing
Thermostats
Upper and Lower Intake

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SECTION VI
CUSTOMER ASSISTANCE

TECHNICAL SERVICE

For technical service please contact Powertrain Integration at **855-305-1500.**

WARRANTY CLAIMS

Upon initial discovery of an engine needing repair, please call Powertrain Integration Warranty Services at **855-305-1500.**

COMPONENT ORDERS

For component orders or pricing, contact Powertrain Integration at sales@ptintegration.com or **855-305-1500**

POWERTRAIN INTEGRATION SERVICE WEB SITE

www.service.powertrainintegration.com

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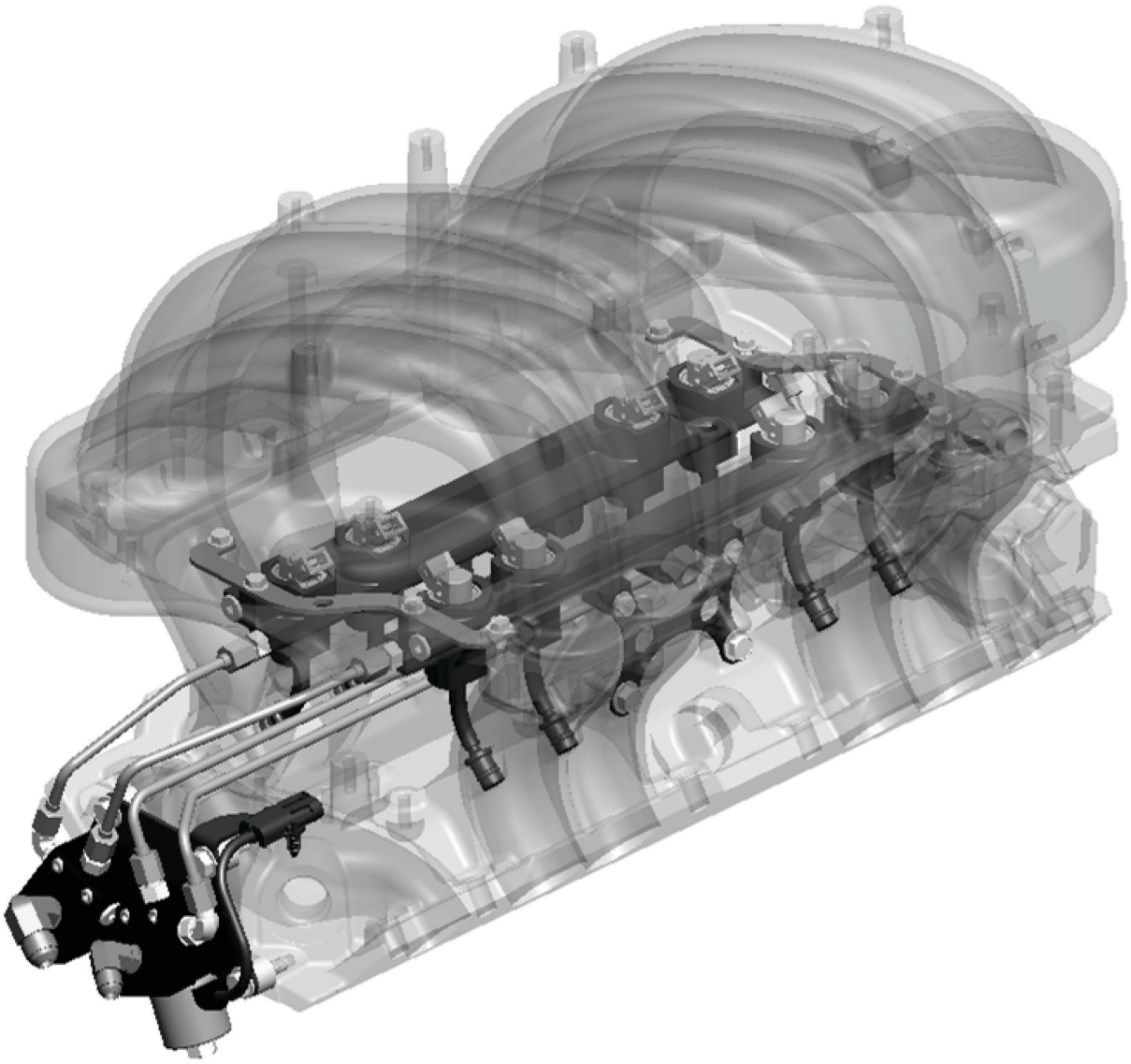
OPERATOR'S MANUAL
DEDICATED LIQUID PROPANE INJECTION
8.0 L V8 ENGINE



LIQUID PROPANE INJECTION

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INTRODUCTION

This vehicle has been designed and built to operate on Liquefied Petroleum Gas (LPG), commonly referred to as propane autogas.

This manual contains the latest information available at the time of publication. CLEANFUEL USA reserves the right to make changes in the products or information contained in this manual without written notification unless the changes specifically affect your vehicle or safety. In this case you will be notified.

This manual should remain in the vehicle for reference. When you sell or trade your vehicle, please leave this manual in the vehicle for the future owner.

MODELS COVERED IN THIS MANUAL

This manual contains general information pertaining to vehicles that contain the 8.0L Dedicated LPI® (Liquid Propane Injection) Engine.

The information contained herein is meant to supplement the OEM Operator Manual, and is specific to the operation of the LPI® Fuel System.

Failure to fulfill any maintenance, service, or operational requirements in either the OEM Operator Manual or this supplement may void the warranty.

USING THIS MANUAL

This manual contains information which is unique to the propane fuel system and may supersede information in the base vehicle manual. If, after reviewing the information contained in this manual, you have questions, please contact Technical Service at 1-855-305-1500

It is recommended that you review this manual completely before you operate your vehicle. This will allow you to become familiar with the unique operation and features of your propane powered vehicle.

SAFETY WARNINGS

This manual contains multiple safety warnings, labeled “WARNING”. These warnings are extremely important. Failure to follow them could result in property damage, personal injury, or death. Please read this manual thoroughly and familiarize yourself with the warnings.

⚠ WARNING

Propane is extremely flammable. Keep sparks and open flames away from propane. Do not smoke while refueling your vehicle.

⚠ WARNING

Liquid propane can cause serious burns to skin or eyes. Prevent contact when handling propane by wearing approved hand and eye protection.

⚠ WARNING

Service and repair of the propane fuel system should only be performed by trained service technicians. The propane fuel system requires special tools to make repairs. To prevent personal injury or damage to the fuel system do not attempt repairs

⚠ WARNING

Never cut or weld on the propane storage tank. Severe bodily injury or fire could result.

SECTION I
DRIVING AND OPERATING

STARTING A LPI® ENGINE

With the parking brake set, move the shift lever to N (Neutral). A safety feature prevents the engine from starting in any other position.

Starting your propane vehicle is different than a gasoline vehicle. Before the vehicle will start, the fuel lines and injectors must be refilled with liquid fuel. A priming process is used to fill the system with liquid propane each time the ignition key is turned ON.

STARTING PROCEDURE

1) Turn the key to the ON but engine off position. At this time the wait to start light will illuminate on the dash panel.

2) After the light turns off (5 to 10 seconds.) with your foot off the accelerator pedal, turn the key to the start position. When the engine starts, release the key. High idle might be experienced on startup; Idle speed will go down as the engine warms up. Do not race the engine upon starting; operate gently to allow proper warm up and lubrication of all internal parts.

Note: Long cranking times can cause the starting

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motor to overheat and cause damage. Wait 15 seconds between each cranking cycle to allow starter to cool down.

3) If the engine fails to start in two to three seconds during engine cranking sequence, turn the key back to the "Off" position and repeat the starting procedure.

If the engine still does not start, check the fuel level. If the gauge registers an adequate fuel level and the engine still won't start, the vehicle may require servicing.

EVAPORATIVE SYSTEM PUMP

This vehicle utilizes an evaporative emissions system that uses a pump. This pump will operate when the vehicles engine has been shut off. This pump will cycle frequently for up to 72 hours—this is normal.

FUEL

This vehicle is designed to operate on Liquefied Petroleum Gas (LPG or Propane). Propane vehicles are recognized for their contribution to lower emissions, cleaner air, and lower operating costs.

High automotive grade propane is required and must meet the following automotive standards for fuel composition and quality:

- HD5 grade propane in the United States.
- HD10 grade propane in California.
- Grade 1 Propane in Canada.

Propane that does not meet or exceed the above standards may decrease engine performance, damage vital LPI® system components or emission controls. Damage to components resulting from contamination is NOT covered under warranty.

LPG is a colorless, odorless, highly flammable gas. A distinctive odorant is added to LPG to alert anyone nearby in the event of a leak. The odor smells similar to sulfur or rotten eggs.

FILLING YOUR LPI® FUEL TANK

REFUELING STATION INFORMATION

A list of public and private LPG filling stations may be found on the following government website:

http://www.afdc.energy.gov/locator/stations/

LPI® Engine systems use a fuel tank design different from the traditional LPG engine systems. The LPI® tank typically has a higher operating pressure than a LPG Vapor system tank, resulting in a slower fill rate than experienced with older LPG Systems.

While there are many places which sell LPG as an engine fuel, it is recommended that you fill your LPG powered vehicle at filling stations capable of filling autogas vehicle tanks.

Note: Propane is a liquid fuel. Parking the vehicle on an uneven surface during refueling could result in the vehicle being over or under filled.

Before refueling you should familiarize yourself with the location of the refueling connectors on your vehicle. Unless you are trained and experienced with filling your LPG fueled vehicle, consult a qualified propane station operator.

The LPI® fuel tank equipped with both an 80% fixed level gauge and an automatic OPD (Overfill Protection Device) in accordance with NFPA 58. The LPI® system is designed to be filled safely and reliably using only the OPD. Therefore the usage of the 80% fixed liquid level valve is not required. There is a required annual verification of the 80% valve's accuracy. Take your vehicle to a certified LPI® service provider for annual OPD inspections.

PROPER REFUELING PROCEDURES

1) Park the vehicle on level ground to ensure that the tank is properly filled.
2) Turn the engine off and set the parking break. Set wheel chocks if required.
3) Ensure there are no open flames or ignition sources.
4) Remove the refueling valve cap by turning the cap counter clockwise. (Be sure to retain the cap for replacement after filling.) **Note:** Replacement filler valve caps can be obtained from CLEANFUEL USA or a CLEANFUEL USA distributor. Part number: VAX-0502-S
5) Inspect the fill valve O-ring.

Note: Make sure the O-ring is seated in the groove and is not damaged or missing.
Note: A new O-ring can be obtained from CLEANFUEL USA or a CLEANFUEL USA distributor. Part number: VAX-0503-S.

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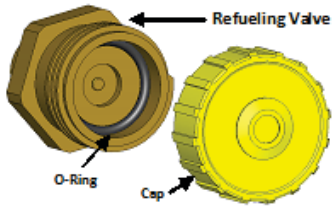

Refueling valve and cap

WARNING

Never connect the fill nozzle to the refueling valve if the O-ring is missing or damaged. This could cause serious injury or property damage.

6) Connect the propane fill nozzle to the fill valve.
7) Rotate the fill valve nozzle clockwise until it is firmly attached to the fill valve.
8) Close the fill nozzle vent valve if equipped.
9) It is not required to use the 80% liquid level valve. Only open if required by fill station.
10) Turn the propane dispenser ON.
11) Open valve on refueling nozzle to begin refueling.
12) When the OPD stops the flow of fuel into the tank, close the valve on the refueling nozzle (If required to use the 80% liquid level gauge, stop filling when liquid from the level gauge appears in the form of a white cloudy vapor.)
13) Turn the propane dispenser OFF.
14) If equipped, open the fill nozzle vent and safely release the pressure from the fill nozzle.
15) Carefully disconnect the filling nozzle from the refueling valve by rotating the fill nozzle connector counter clockwise.
16) Return the fueling nozzle to the dispenser.
17) Reinstall the refueling valve cap.

FUEL SYSTEM LEAK

WARNING

If you smell a persistent propane odor or hear a continual hissing sound, there could be a propane leak. If the propane is ignited, you or others could be injured. Do not start the engine or drive the vehicle. Have your vehicle towed to an OEM authorized service facility for service.

A slight odor of propane may be present for a few moments after refueling your vehicle. This is normal. You should not be able to smell propane at any other time. If you do, or if you hear a constant hissing sound, the fuel system may have a leak.

If you smell propane or a constant hissing sound is audible:

1) Park the vehicle in a well-ventilated area and apply the parking brake. Keep heat, sparks, and flames away. Open all doors for ventilation.
Note: Do not lower your windows.
2) Turn the ignition to OFF.

Do not drive the vehicle until the leak is found and repaired. The vehicle should be towed to an OEM authorized service facility.

SECTION II
GENERAL VEHICLE CARE

JUMP STARTING

WARNING

If the LPI® Propane fuel system has a leak a spark from the jumper cables could ignite the gas, causing injury or death. Do not attempt to jump start your vehicle if a strong smell of propane is present or you hear a continual hissing sound. Have the vehicle towed to an OEM authorized service facility.

See “Jump Starting” in the OEM operator manual.

TOWING YOUR VEHICLE

WARNING

Towing your vehicle with improperly positioned tow straps, hooks, or chains can damage LPI® components such as the propane tank, fuel lines, or components. Serious damage or injury could result. Do not use the propane fuel system components as a towing attachment points.

See the OEM operator manual for information regarding towing the disabled vehicle.

STORING THE VEHICLE

If you plan on storing your vehicle for an extended period of time (60 days or more) refer to the “vehicle storage” in your OEM operator manual for information on the base vehicle. Also:

1) Close the manual shut-off valves. (Refer to Page 32 on closing your manual shut-off valves.
2) If you suspect a leak, get your vehicle inspected by an OEM authorized service facility before putting your vehicle in storage.

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RETURNING TO SERVICE

1) Open all manual shut-off valves.
2) Ensure the battery is fully charged.
3) After prolonged storage or periods of not running, it may be difficult to start the engine as the fuel system will need to be primed. It may be necessary to operate the “Wait to Start” prime cycle several times.

Note: It is recommended that any stored vehicle be started once a month to keep all fuel system components lubricated. Storing a vehicle for long periods may require much more work to return to normal running order.

LIFTING YOUR VEHICLE

⚠ WARNING

Never place a jack on the fuel storage tank or fuel system components to raise the vehicle. Serious damage to the LPI® system components, tank, or tank mounting may result. Lifting on the tank structure, valves, or mounting attachments can result in fuel leaks or damage to the tank mounting devices.

See “Tire Changing” in the OEM operator manual for proper jacking instructions. Use only the jacking points recommended in the owner’s manual. Always inspect the jacking point to make sure there is no contact to the fuel supply lines or storage tanks.

PAINTING THE VEHICLE

In the event if the vehicle requires painting this process should not be cured by heating. The LPI® fuel tank is equipped with a pressure release device. The pressure relief valve will open at 312 PSI (2151KPA) if heated to approximately 140°F (60°C).

Note: In the event the vehicle requires a paint process that is cured by heating, the tank will need to be removed and reinstalled by an OEM authorized service facility.

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SECTION III
SERVICE AND MAINTENANCE

MAINTAINING YOUR VEHICLE

WARNING

Never try to service the LPI® propane fuel system yourself. The LPI® fuel system operates under high pressure. You could be injured and the vital system components can be damaged. Service should be only performed by LPI® certified dealers.

Your LPI® vehicle is designed for routine maintenance (filters, fluids, etc.) See the original specifications as provided in the engine owner's manual for specific maintenance service intervals and fluid specifications.

In addition, the LPI® system has required maintenance service internals. See your dealer for required service and maintenance. Your dealer has the necessary training and parts to repair the vehicle.

CFUSA LPI® FUEL SYSTEM
RECOMMENDED MAINTENANCE SCHEDULE

DESCRIPTION OF MAINTENANCE	FREQUENCY					
	Annually	Daily	5000 Miles	10,000 Miles	20,000 Miles	30,000 Miles
Fuel Tank Inspection	X					X
Check for damage	X					X
Leak check all tank fittings and connections	X					X
Check all tank mounting hardware	X					X
OPD **(Overfill Protection Device)** Function Verification	X					
Fuel Lines						
Inspect lines for damage	X					X
Leak check all line fittings	X					X
Fuel Injector Rail and Injectors						
Leak check rail fittings and injectors	X					X
Injectors electrical connectors	X					X
Evaporative Emissions System						
Check all connections are fully connected	X					X
Check pump cover has no damage	X					X
Check electrical connector on pump	X					X
Fill Filter and Inline Filters						
Replace filters						X

This maintenance schedule represents CleanFUEL USA recommended maintenance intervals to insure safe & reliable operation of the CleanFUEL USA LPI® (Liquid Propane Injection) fuel system. Vehicles which operate in harsh environments may require operators to perform more comprehensive or frequent inspections. If you have any questions regarding the maintenance procedures and or question regarding the system please contact you CleanFUEL USA Service provider.

SECTION IV
TECHNICAL INFORMATION

LPI® FUEL TANK CAPACITY

LPI® Vehicle Tank Formats	Usable Capacities	
	English	Metric
Side Mounted Tank	60.8 Gal	230.1 L
Between the Frame Rail Mounted Tank	67 Gal	253.6 L

PROPANE DIAMOND STICKER

If not purchased with a body, some vehicle applications may not have a propane diamond sticker attached to the rear of the vehicle. This label is required by law in the United States and Canada. This label is to be affixed to the right-rear of the vehicle body, NOT to the bumper, and is required to alert emergency personnel that the vehicle runs on propane autogas, in the event of an accident.

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To attach this sticker:

1) Clean the area you wish to place sticker with soapy water solution. Be sure to remove excess soap.

2) When the area is dry, apply the sticker by pushing down on the middle first, then working your way out to the edges.

Note: New propane diamond stickers can be obtained from your dealership.

SIDE MOUNTED TANK

FUEL SHUT OFF

To shut off the supply of fuel to the engine, both the supply and return valves will need to be closed.

Note: Be sure to open both valves before starting the vehicle. Failure to turn both valves on will cause fuel pump failure.

1) Locate the supply valve.
(Figure 1)
2) To shut off the supply valve, turn the valve handle clockwise until it reaches its stop (Roughly three and a half turns). **NOTE: Damage may occur if the valve is over tightened.**
3) Locate the return valve.
(Figure 2)
4) To shut off the return valve, turn the valve handle clockwise until it reaches its stop (Roughly two and a quarter turns). **NOTE: Damage may occur if the valve is over tightened.**
5) To turn valves on, turn both the return and supply valve counter clock-wise until you reach valve stop.

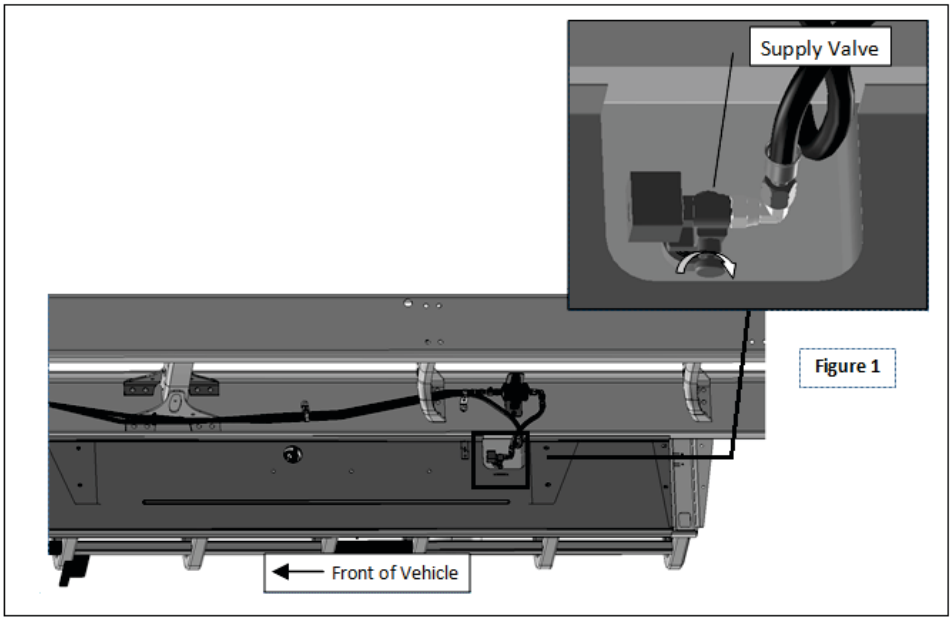

Figure 1

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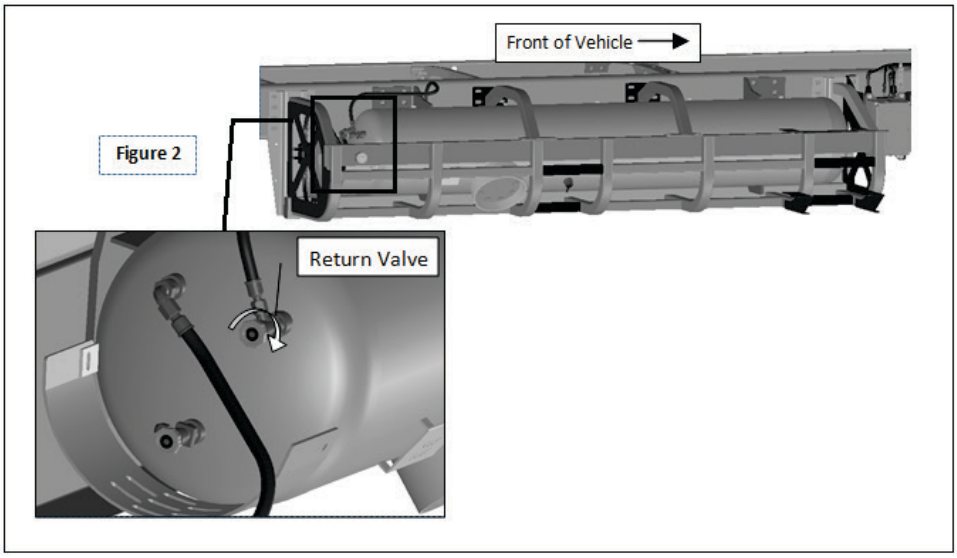

Side Mounted Tank

BETWEEN THE FRAME RAIL MOUNTED TANK FUEL SHUT OFF

To shut off the supply of fuel to the engine, both the supply and return valves will need to be closed.

Note: Be sure to open both valves before starting the vehicle. Failure to turn both valves on will cause fuel pump failure.

1) Locate the supply valve. (Figure 3A & 3B)
2) To shut off the supply valve, turn the valve handle clockwise until it reaches its stop (Roughly three and a half turns). **NOTE: Damage may occur if the valve is over tightened.**
3) Locate the return valve. (Figure 3C)
4) To shut off the return valve, turn the valve handle clockwise until it reaches its stop (Roughly two and a quarter turns). **NOTE: Damage may occur if the valve is over tightened.**
5) To turn valves on, turn both the return and supply valve counter clock-wise, until you reach valve stop.

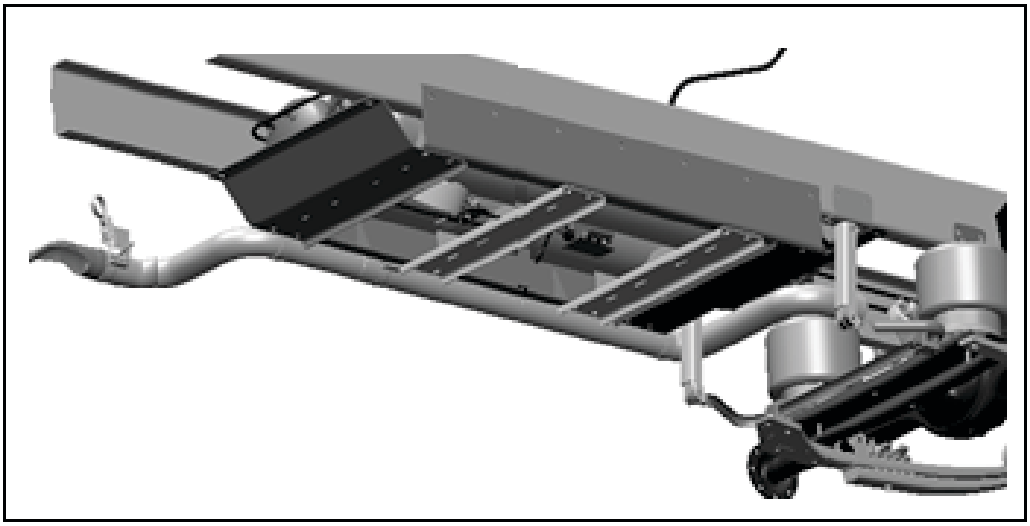

Figure 3A between the Frame Rail Mounted Tank Valve Location

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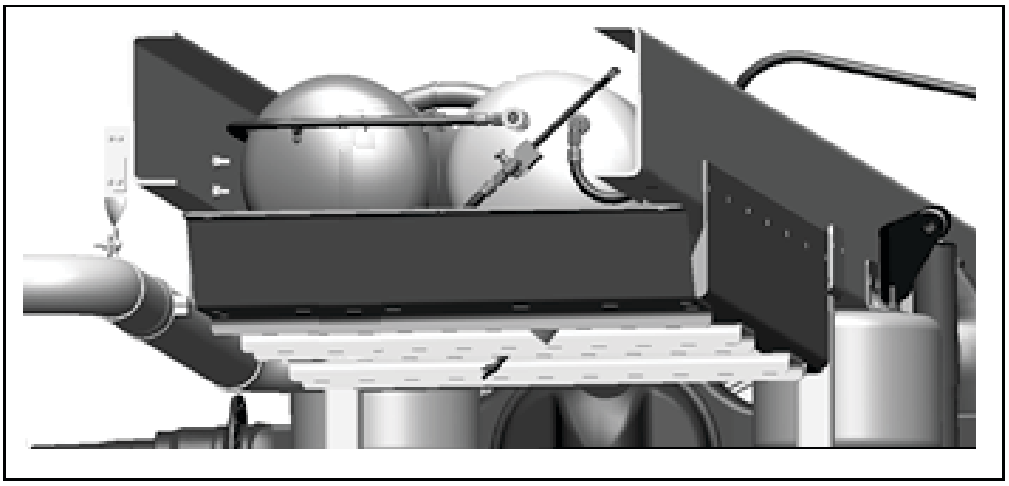

Figure 3B between the Frame Rail Mounted Tank Valve Location

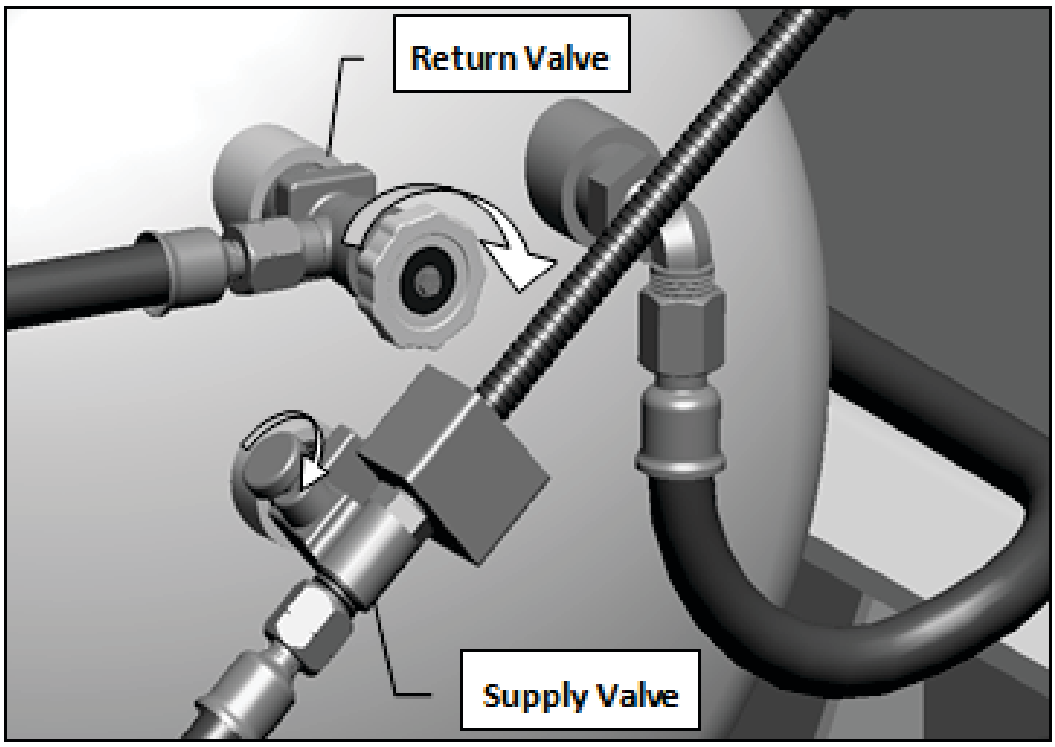

Figure 3C Thomas Built - SAF-T-Liner® C2 Valve Location

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SECTION V

CleanFUEL USA WARRANTY

CleanFUEL USA (CFUSA) Limited Warranty Freightliner LPI® 8.0L Engine Fuel System

School Bus 5 Years / 100,000 Mile /160,000 km
Delivery Truck 2 Years / Unlimited Miles or 2,000 hours

Warranty Coverage applies to the above Freightliner truck formats. This warranty is a supplemental limited warranty to your new Freightliner base vehicle warranty. Certain components unassociated to the LPI® fuel system may be covered by different manufacturers. This warranty provides coverage to any malfunction of the LPI® fuel system resulting from defects in materials or workmanship. The original manufacturer's warranty, Freightliner or Powertrain Integration, remains valid. Federal emissions warranty is 5 years/50,000 miles, and California emissions warranty is 7 years/70,000 miles. For more specific information about EMISSIONS CONTROL SYSTEMS warranty, call CFUSA at 855-305-1500. In California, new motor vehicles must be designated, built and equipped to meet the State's more stringent anti-smog standards. If your vehicle fails a SMOG inspection, all necessary repairs should be obtained through a CFUSA LPI® MASTER DEALER. If an emission related part malfunctions it will be repaired or replaced at no charge during the emissions warranty period.

What is covered:

- Propane tank & all associated components to the tank including the internal fuel pump, fuel lines, mounting hardware, multi-valve, safety relief valve, fill valve, service valve and fuel level gauge.
- Fuel injectors, fuel rails, fuel supply & return lines, fittings and mounting hardware.
- Evaporative fuel handling components added or modified for the LPI® fuel system.
- Wiring harness or wiring components added specifically for the LPI® fuel system.
- Proprietary CFUSA electronic evaporative emissions control calibration.
- Any vehicle system failure caused by or resulting from a failure of the LPI® fuel system.

What is not covered:

- Any malfunction that is not related to the LPI® fuel system.
- Any component that is not associated with the LPI® fuel system.
- Components that have failed due to vehicle modification or alteration.
- Components considered maintenance items identified in the 8.0L Engine Owner's Manual Supplement; e.g. filters.
- Any failure resulting from fuel contamination or the use of LPG not meeting the specifications of HD-5 propane. (See LPI® Owner's Manual Supplement for more info about HD-5 PROPANE)
- Costs of scheduled maintenance or failures due to lack of scheduled maintenance as identified in the 8.0L Engine Owner's Manual Supplement.
- Any failure resulting from abuse or neglect.
- A repair due to accidents or comprehensive losses.
- CFUSA is not responsible for incidental or consequential costs or expenses which the owner may incur as a result of a malfunction or failure covered by this warranty such as: vehicle damage, vehicle towing, communication expenses, meals, lodging, overtime, loss of use, loss of time, inconvenience, cargo loss or damage and other similar costs and expenses including the loss of fuel in the event of an internal tank repair.

Obtaining warranty service:

- Call or visit a Freightliner dealer or authorized LPI® service provider.
- Call CFUSA at 855-305-1500 for authorized service, warranty information and technical support.
- Only a CFUSA authorized service center should perform warranty repairs.
- Any service provider that works on the fuel system must have appropriate license where required by applicable federal, state or local laws pertaining to the handling of propane (laws vary by state).

Owner's Responsibilities:

- As the vehicle owner, you are responsible for the performance of the required maintenance listed in your owner's manual. CleanFUEL USA recommends that you retain all receipts covering maintenance of your vehicle, although CleanFUEL USA cannot deny warranty solely for the lack of receipts.
- You are responsible for presenting your truck to a CleanFUEL USA dealer as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time.
- As the truck owner, you should also be aware that CleanFUEL USA may deny you warranty coverage if any of the above conditions are met and or if your vehicle or part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

THIS LIMITED WARRANTY IS THE ONLY WARRANTY APPLICABLE TO THE FUEL SYSTEM AS USED IN ON-ROAD VEHICLE APPLICATIONS. CFUSA MAKES NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CFUSA SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES AS DESCRIBED ABOVE. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF CERTAIN DAMAGES OR THE DURATION OF IMPLIED WARRANTIES OR CONDITIONS SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

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EMISSION COMPONENTS FOR 8.0L V8 LPG-FUELED ENGINES WARRANTY COVERAGE

School Bus and Delivery Vehicle

Federal Emissions Warranty
5 Years, 50,000 miles / 80,000 km*
*Whichever occurs first.

California Emissions Warranty
7 Years, 70,000 miles / 113,000 km*
*Whichever occurs first.

Camshaft Sensor

Coolant Temperature Sensor

Crankshaft Position Sensor Assembly

Engine Control Module

Evaporative Charcoal Canister

Evaporative Controller

Evaporative Emissions Valve Assembly

Evaporative Pump

Evaporative System Housing

Fuel Injectors

Fuel Regulator

Knock Sensor

Mass Air Flow Sensor

Positive Crankcase Ventilation Valve

Propane Fuel Tank

Throttle Body

Torque Security Module

LIQUID PROPANE INJECTION WARRANTY COVERED PARTS

School Bus
5 Years, 100,000 miles / 160,000 km*
*Whichever occurs first.

Delivery Vehicle
2 Years Unlimited miles or 2,000 hours*
*Whichever occurs first.

80% Mechanical Fill Valve

Evaporative Purge Hoses

Evaporative System Hoses

External Fuel Gauge

Filler Hoses

Fuel Supply and Return Hoses

Fuel Supply and Return Lines (Stainless Steel)

Liquid Evacuation Valve

Mechanical Fuel Gauge / Float

Return Valve

Safety Relief Valve

Supply Valve and Solenoid

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SECTION VI
CUSTOMER ASSISTANCE

TECHNICAL SERVICE

For technical service please contact CleanFUEL USA at **1-855-305-1500**

WARRANTY CLAIMS

Upon initial discovery of an engine needing repair, please call Powertrain Integration Warranty Services at **1-805-305-1500.**

COMPONENT ORDERS

For component orders or pricing, contact CleanFUEL USA at **1-805-305-1500**

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